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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/771,843	02/04/2004	LeNoir E. Zaiser	2173.2007-001	9748

59242 7590 09/21/2009
R.D. JOHNSON & ASSOCIATES, P.C.
20 PICKERING STREET
P.O.BOX 920353
NEEDHAM, MA 02492

EXAMINER	
WEINSTEIN, LEONARD J	

ART UNIT	PAPER NUMBER
3746	

MAIL DATE	DELIVERY MODE
09/21/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/771,843	ZAISER ET AL.	
	Examiner	Art Unit	
	LEONARD J. WEINSTEIN	3746	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 23 July 2009.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 3,9-15,19-24,27,33-39 and 43-68 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 3,9-15,19-24,27,33-39 and 43-68 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. This office action is in response to the amendment of July 23, 2009. In making the below rejections and/or objections the examiner has considered and addressed each of the applicant's arguments.

2. The examiner acknowledges the amendments to claims 3, 11, 15, 21, 27, 35, 39, 45, 49, and 54. The examiner notes that claims 59-68 have been introduced.

Claim Objections

3. Claims 39 and 54 are objected to because of the following informalities: the recitation of "a compression stroke in the first piston" in both claims should be amended to recite --- a compression stroke in the first piston <u>chamber</u> --- as best understood by the examiner. Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 11, 21, 35, and 45 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

6. Claims 11, 21, 35, and 45 recite the limitation of "a second pressure sensor." There is insufficient antecedent basis for this limitation in the claim because in the amendment of July 23, 2009 these claims were amended to depend on independent claims 49, 15, 54, and 39 respectively. The independent claims do not introduce a discrete element that constitutes a first pressure sensor. Claims 11, 21, 35, and 45

introduce the first actual sensor to an apparatus of claims 15 and 39 and method of claims 49 and 54. Therefore antecedent basis for a second element of a certain type is lacking where there has been no introduction of a first element of that type.

Claim Rejections - 35 USC § 103

7. Claims 3, 9-11, 15, 19-21, 27, 33-35, 39, 43-45, and 49-68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Richey, II et al. US 5,988,165 in view of Muratsubaki et al. US 6,068,448.

a. With respect to apparatus claims 15 and 49

i. Richey, II et al. US 5,988,165 - With respect to apparatus claims 15 and 49 Richey teaches all the limitations for a multistage pump for pressurizing a volume of fluid including: **[claims 15 and 49]** a controller (circuitry for compressor 100 shown in figures 4 and 5) in communication with a drive system 105 of a pump/compressor 100 that initiates a piston cycle (piston cycle of pistons 131, 132, and 133) by initiating a compression stroke in a first piston 131 in response to the detection of predetermined pressure within a chamber (buffer tank 200) which corresponds to the pressure in a first piston chamber (chamber defined by cylinder housing element 131 and piston face of piston 131a - see figure 8; Richey - col. 11 ll. 6-29; col. 11 ll. 67-col. 12 ll. 5); **[claims 10 and 20]** a first pressure sensor (Richey - col. 11 16-19) for sensing fluid pressure in the first piston chamber (chamber defined by cylinder housing element 131 and piston face of piston 131a - see figure 8; Richey - col. 11 ll. 6-29;

col. 11 ll. 67-col. 12 ll. 5); **[claims 50 and 52]** wherein the fluid is a gas (oxygen – Richey – col. 11 ll. 6-8); **[claims 51 and 53]** and wherein the gas includes concentrated oxygen; (Richey – col. 11 ll. 6-8); **[claims 59 and 64]** the motor 105 has a variable rotational speed (Richey – col. 8 ll. 17-20).

ii. Richey does not teach the limitations directed toward specific structural components that are taught by Muratsubaki et al. US 6,068,448 for a multistage pump including: **[claim 15]** a housing (10A, 10B, 11) having a first cylindrical chamber 12A and a second cylindrical chamber 12B, the first chamber 12A having a first inlet 32 and a first outlet (34/44), the second chamber 12B having a second inlet (34/46) and a second outlet 36, the second inlet (34/46) of the second chamber 12B being in communication with the first outlet (34/44) of the first chamber 12A, a first piston 13A positioned within the first chamber 12A to define a first piston chamber 12A, a second piston 13B positioned within the second chamber 12B to define a second piston chamber 12B the volume of the first piston chamber 12A being larger than the volume of the second piston chamber 12B (col. 9 ll. 62—col. 10 ll. 12), a connecting member (13, 14) for securing the first and second pistons (13A, 13B) together in a spaced apart manner along a common axis (as shown in figure 1), and extending between the first and second chambers (12A, 12B), the connecting member (13, 14) including a threaded portion 13, a drive system (14, 21,

22) for reciprocating the first and second pistons (13A, 13B) in unison within the first and second piston chambers (12A, 12B) such that when the first piston 13A is moving in an expansion stroke, fluid is drawn into the first piston chamber 12A through the first inlet 32, and at the same time, the second piston 13B is moving in a compression stroke where fluid is expelled from the second piston chamber 12B through the second outlet 36, and when the first piston 13A is moving in a compression stroke, the second piston 13B is moving in an expansion stroke where fluid is expelled from the first piston chamber 12A through the first outlet (34/44) and into the second piston chamber 12B through the second inlet (34/46) where the fluid is compressed due to the reduced volume of the second piston chamber 12B (col. 9 ll. 62 - col. 10 ll. 12), the drive system (14, 21, 22) including a rotatable ball screw nut 14 engaged with the threaded portion 13 and a reversible motor 21 for alternately rotating the nut 14 in opposite directions to cause reciprocating linear translation of the connecting member (13, 14) and pistons, and a check valve system (42, 44, 46, 48) for maintaining a unidirectional flow of fluid from the first inlet 32 to the second outlet 36;

Further Muratsubaki teaches all the limitations claimed for a multistage pump including: **[claim 49]** a housing (10A, 10B, 11) having an input line 18 for receiving a fluid and an output line 72 for delivering the fluid (col. 9 ll. 62 – col. 10 ll. 12), a first piston 13A operable in an

expansion stroke and a compression stroke in a first piston chamber 12A in the housing (10A, 10B, 11), the first piston chamber 12A having a first inlet 32 in fluid communication with the input line 18 and a first outlet (34/44), wherein during the expansion stroke fluid flows into the first piston chamber 12A through the first inlet 32 and during the compression stroke the fluid is forced out through the first outlet (34/44), a second piston 13B operable in an expansion stroke and a compression stroke in a second piston chamber 12B in the housing (10A, 10B, 11), the second piston chamber 12B having a second inlet (34/46) in fluid communication with the first outlet (34/44) of the first piston chamber 12A and a second outlet 36 in fluid communication with the output line 72, wherein the second piston chamber 12B has a smaller volume than the first piston chamber 12A (col. 9 ll. 62 – col. 10 ll. 12), wherein during the expansion stroke fluid is drawn into the second piston chamber 12B through the second inlet (34/46) and during the compression stroke the fluid is forced out through the second outlet 36, a connecting member (13, 14) securing the first piston 13A and the second piston 13B together in a spaced apart manner along a common axis, as shown in figure 1, the connecting member (13, 14) having threads (as defined on element 13) along a portion of its length, a ball screw drive system (14, 21, 22) in communication with the threads (as defined on element 13) on the connecting member (13, 14) for reciprocating the connecting member (13, 14) such that when the first

piston 13A is in an expansion stroke, the second piston 13B is in a compression stroke, and when the first piston 13A is in a compression stroke, the second piston 13B is in an expansion stroke; **[claim 3]** and a connecting member (13, 14) includes a threaded portion 13, the drive system (14, 21, 22) including a reversible motor 21 engaging the threaded portion 13, via elements 14 and 22,for alternately moving the connecting member (13, 14) in opposite directions, to cause reciprocating linear translation of the connecting member (13, 14) and pistons (13A, 13B).

With respect to the limitations claimed that are in dependent from and common to independent claims 15 and 49 Muratsubaki teaches all the limitations claimed for a multistage pump including: **[claims 9 and 19]** a piston position sensing system (col. 14 ll. 4-12) coupled to the drive system (14, 21, 22) to detect when the pistons (13A, 13B) have reached a predetermined stroke and to reverse the drive system (14, 21, 22); **[claims 11 and 21]** a pressure sensor 64 for sensing the pressure of fluid expelled from the second piston chamber 12B; **[claims 59 and 64]** the reversible motor 21 has a variable rotational speed (as period and speed are dependent upon target pressure which can be varied – see Muratsubaki – col. 11 ll. 21-44, col. 14 ll. 4-29); **[claims 60 and 65]** wherein the rotation speed varies during the piston cycle (Muratsubaki – col. 14 ll. 4-29); **[claim 63]** and a plurality of check valves (42, 46, 48) for

maintaining a unidirectional flow of fluid from the first inlet 32 to the second outlet 36.

b. With respect to method claims 39 and 54

i. Richey, II et al. US 5,988,165 - Richey teaches all the limitations for a method of compressing a volume of fluid including the steps of: **[claims 39 and 54]** initiating piston cycle (piston cycle of pistons 131, 132, and 133) by initiating a compression stroke in a first piston chamber (chamber defined by cylinder housing element 131 and piston face of piston 131a - see figure 8) from a controller (circuitry for compressor 100 shown in figures 4 and 5) in communication with a drive system 105 in response to the detection of a predetermined pressure within the first piston chamber (chamber defined by cylinder housing element 131 and piston face of piston 131a - see figure 8; Richey - col. 11 ll. 6-29; col. 11 ll. 67-col. 12 ll. 5); **[claims 34 and 44]** the step of sensing the fluid pressure in the first piston chamber (chamber defined by cylinder housing element 131 and piston face of piston 131a - see figure 8; Richey - col. 11 ll. 6-29; col. 11 ll. 67-col. 12 ll. 5) with a first pressure sensor (Richey - col. 11 16-19); **[claims 55 and 57]** the step of the method wherein the fluid is a gas (oxygen – Richey – col. 11 ll. 6-8); **[claims 56 and 58]** the step of the method wherein the gas includes concentrated oxygen; (Richey – col. 11 ll. 6-8); **[claims 61 and 67]** the step of the method wherein the motor 105 has a variable rotational speed (Richey – col. 8 ll. 17-20).

ii. Richey does not teach the limitations directed toward specific structural components used to perform a method of pressurizing a volume of fluid that are taught by Muratsubaki et al. US 6,068,448 including the steps of: **[claim 39]** operating a first piston 13A within a first cylindrical chamber 11A defining a first piston chamber 12A in a housing (10A, 10B, 11), the first piston chamber 12A having a first inlet 32 and a first outlet (34/44), operating a second piston 13B within a second cylindrical chamber 11B defining a second piston chamber 12B in the housing (10A, 10B, 11), the volume of the first piston chamber 12A being larger than the volume of the second piston chamber 12B (col. 9 ll. 62 – col. 10 ll.12), maintaining the first and second pistons (13A, 13B) secured together in a spaced apart manner along a common axis with a connecting member (13, 14), the connecting member (13, 14) including a threaded portion (as defined by the threaded portion of element 13), reciprocating the first and second pistons (13A, 13B) in unison within the first and second piston chambers (12A, 12B) with a drive system (14, 21, 22) such that when the first piston 13A is moving in an expansion stroke, fluid is drawn into the first piston chamber 12A through the first inlet 32, and at the same time, the second piston 13B is moving in a compression stroke where fluid is expelled from the second piston chamber 12B through the second outlet 36, and when the first piston 13A is moving in a compression stroke, the second piston 13B is moving in an expansion stroke where fluid is

expelled from the first piston chamber 12A through the first outlet (34/44) and into the second piston 13B chamber 12B through the second inlet (34/46) where the fluid is compressed due to the reduced volume of the second piston chamber 12B, the drive system (14, 21, 22) including a rotatable ball screw nut 14 engaged with the threaded portion (thread portion of element 13) and a reversible motor 21 for alternately rotating the nut 14 in opposite directions to cause reciprocating linear translation of the connecting member (13, 14) and pistons (13A, 13B) – (col. 10 ll. 34-50), and maintaining a unidirectional flow of fluid from the first inlet 32 to the second outlet 36 with a check vane system (42, 44, 46, 48);

Further Muratsubaki teaches all the limitations claimed for a method of compressing a volume of fluid including: **[claim 54]** the steps of receiving a fluid into a housing (10A, 10B, 11) through an input line 18 and delivering the fluid through an output line 72 (col. 9 ll. 62 – col. 10 ll. 12), operating a first piston 13A in an expansion stroke and a compression stroke in a first piston chamber 12A in the housing (10A, 10B, 11), the first piston chamber 12A having a first inlet 32 in fluid communication with the input line 18 and a first outlet (34/44), wherein during the expansion stroke fluid flows into the first piston chamber 12A through the first inlet 32 and during the compression stroke the fluid is forced out through the first outlet (34/44), operating a second piston 13B in an expansion stroke and a compression stroke in a second piston chamber 12B in the housing (10A,

10B, 11), the second piston chamber 12B having a second inlet (34/46) in fluid communication with the first outlet (34/44) of the first piston chamber 12A and a second outlet 36 in fluid communication with the output line 72, wherein the second piston chamber 12B has a smaller volume than the first piston chamber 12A, wherein during the expansion stroke fluid is drawn into the second piston chamber 12B through the second inlet (34/46) and during the compression stroke the fluid is forced out through the second outlet 36 (col. 9 ll. 62 – col. 10 ll. 12), securing the first piston 13A and the second piston 13B together with a connecting member (13, 14) in a spaced apart manner along a common axis, the connecting member (13, 14) having threads (as defined by the threaded portion of element 13) along a portion of its length, operating a ball screw drive system (14, 21, 22) in communication with the threads (as defined by the threaded portion of element 13) on the connecting member (13, 14) to reciprocate the connecting member (13, 14) such that when the first piston 13A is in an expansion stroke, the second piston 13B is in a compression stroke, and when the first piston 13A is in a compression stroke, the second piston 13B is in an expansion stroke; **[claim 27]** and the step wherein the connecting member (13, 14) includes a threaded portion (as defined by the threaded portion of element 13), the drive system (14, 21, 22) including a reversible motor 21 engaging the threaded portion (threaded portion of element 13), the method further comprising

alternately rotating the connecting member (13, 14) in opposite directions with the reversible motor 21 to cause reciprocating linear translation of the connecting member (13, 14) and pistons (col. 10 ll. 34-50).

With respect to the limitations claimed that are in dependent form and common to independent method claims 39 and 54 Muratsubaki teaches all the limitations claimed for a method of compressing a fluid including: **[claims 33 and 43]** the step of sensing piston position with a piston position sensing system (col. 14 ll. 4-12); **[claim 35 and 45]** and the step of sensing pressure of fluid expelled from the second piston chamber 12B with a pressure sensor 64; **[claims 61 and 67]** the step of the method wherein the reversible motor 21 has a variable rotational speed (as period and speed are dependent upon target pressure which can be varied – see Muratsubaki – col. 11 ll. 21-44, col. 14 ll. 4-29); **[claims 62 and 68]** the step of the method wherein the rotation speed varies during the piston cycle (Muratsubaki –col. 14 ll. 4-29); **[claim 66]** and the step of maintaining unidirectional flow of fluid from the first inlet 32 to the second outlet 36 using a plurality of check valves (42, 46, 48).

c. Muratsubaki teaches a pump that is used to create a high pressure by routing a volume of fluid from one chamber where fluid is pressured by a first piston traversing through chamber in a compression stroke, to a subsequent second chamber where a second piston that is linked to the first piston is traversing through a second chamber in an expansion stroke. When the

compression stroke of the first piston is completed a reversible motor drives the first and second piston assembly in a second direction so that the second piston conducts a compression stroke and fluid within the second chamber is pressurized for a second time to a high pressure. Muratsubaki teaches that this method of fluid pressurization eliminates unneeded fluid circulation that can lower the quality of the fluid being pumped or compressed, and reduce the time it takes for fluid to reach a target pressure (Muratsuabaki – col. 2 ll. 43-51). Richey is directed toward a method and apparatus for forming oxygen enriched gas to be store at a high pressure in a mobile storage unit (Richey – Abstract). An objective of Richey is to be able to store high purity oxygen in a pressure vessel using a compressor with a series of pistons that compress a fluid with a first piston which then travels to a chamber of a subsequent piston to be further compressed. Richey utilizes a labyrinth of fluid passages that are used to transport fluid from one piston chamber to the next. It is noted that in Richey the expansion stroke of each piston does not correspond directly to the compression stroke of any other piston. Muratsubaki minimizes any lost motion of a first piston by using its expansion stroke to further pressurize a fluid volume through its linkage with the second piston. It would have been obvious to one of ordinary skill in the art at the time the invention was made to provide an apparatus and method of pressurizing a volume of fluid, as taught by Richey, with a fluid pump in which a piston assembly with two piston heads is reciprocated by a reversible motor such that the expansion stroke of one piston corresponds the compression

stroke of the second piston, as taught by Muratsubaki, in order to reduce the risk of the negatively affecting the quality of fluid while being able to pressurize the fluid to a desired pressure quickly (Muratsuabaki – col. 2 ll. 43-51).

8. Claims 12-13, 22-23, 36-37, and 46-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Richey, II et al. US 5,988,165 in view of Muratsubaki et al. US 6,068,448. A combination of the references teaches the general conditions of the claimed invention except for the express disclosure of an apparatus for accomplishing a method of compressing fluid including: **[claims 12, 22, 36, and 46]** a ratio of the volume of a first piston chamber to the volume of a second piston chamber is about 12.5 to 1.0; **[claims 13, 23, 37, and 47]** and first and second pistons have a stroke of about 6 inches. It would have been obvious to one having ordinary skill in the art at the time the invention was made to alter the ratio between first and second pumping chambers to be in the range of 12.5 to 1 and a piston stroke being about six inches, since the claimed values are merely an optimum or workable range. It has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

9. Claims 14, 24, 38, and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Richey, II et al. US 5,988,165 in view of Muratsubaki et al. US 6,068,448. A combination of the references teaches the claimed invention except for the limitation of **[claims 14, 24, 38, and 48]** a pump being capable of pumping about 0.5 in.3 of gas at about 2200 psi per piston cycle. The volume of a discharged portion of fluid from a pump and the pressure at which it is discharged is a results effective

variable with the results being 0.5 in.3 of gas at about 2200 psi per piston cycle. It would have been obvious to one having ordinary skill in the art at the time the invention was made to provide a pump that was capable of pumping 0.5 in.3 of gas at about 2200 psi per piston cycle, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Response to Arguments

10. Applicant's arguments with respect to claims 3, 9-15, 19-24, 27, 33-39, and 43-58 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LEONARD J. WEINSTEIN whose telephone number is (571)272-9961. The examiner can normally be reached on Monday - Thursday 7:00 - 5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Devon Kramer can be reached on (571) 272-7118. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Devon C Kramer/
Supervisory Patent Examiner, Art Unit 3746

/Leonard J Weinstein/
Examiner, Art Unit 3746